Marquette Crop Load and Training System Trial for Michigan

Southwest Michigan Research and Education Center, Benton Harbor, MI
Dr. Paolo Sabbatini and P. Murad
Department of Horticulture, Michigan State University

Background and Rationale:
Marquette is a cold-hardy variety getting more attention in the last few years in Michigan with 27 acres recently planted as reported in the 2014 USDA survey. However, there is a lack of data driven information about the potential performance (yield, fruit quality and wine quality) of Marquette grown in Michigan. Our research activity in 2015 followed the trials established in 2012. During the growing season, we concentrated our experimental activities on demonstrating the potential yield of this variety under the growing conditions of Southwest Michigan, in the heart of one of the most important appellation (Lake Michigan Shore AVA) and one of the most important grape-growing region of our state.

Treatments:
The 2014-2015 winter in Michigan was characterized by the polar vortex; temperatures plunged into the sub-zero digits and the extended duration of the cold events severely affected the grapevines; vinifera was decimated and French-American hybrids severely damaged. Our experimental trial on Marquette was partially impacted by the winter temperatures. In Michigan almost 90% bud damage was reported on *vinifera* grapes in several locations, with hybrids at 60%, and American grapes at 30%; even cold-hardy grapes were extensively damaged. Marquette reported bud damage at 10% primary bud mortality in our experimental trial. In 2015, the research was conducted at Southwest Michigan Research and Education Center (SWMREC). The research focused on the effects of yield per vine and canopy management (leaf removal around the cluster zone) on fruit chemical composition from veraison to harvest and canopy growth and development. Three treatments were applied based on the number of clusters counted at the time of fruit set on the vines. All vines within the experimental vineyard were pruned to 100 buds during the dormant period in the previous winter. For this vineyard, the vines were trained to High Wire Cordon (HWC) with 691 vines per acre and the training system consisted of a fruiting wire at a height of 1.7m above the vineyard floor.

Methods:
Marquette vines were planted in 2008 in the experimental vineyard located at Southwest Michigan Education and Research Center (SWMREC) in Benton Harbor, MI. The vines were planted in a random block design as part of a hybrid variety trial in 2008 (NE1020 project). The vines are planted on a spacing of 2.74 m between rows with 2.13 m between vines. At fruit set vines were evaluated and assigned to either one of the three treatments being tested (high cropping, medium cropping, and low cropping; HC, MC and LC, respectively). Crop adjustment was performed manually removing fruit in order to achieve the three levels. After adjustment was made, at veraison leaf removal treatments were applied (LR = leaf removal and NLR = no leaf removal) for each cropping category. All sprayings and vineyard management practices were conducted similar to the rest of the experimental vineyard at this location. At the time of veraison, sampling of fruit started and continued until harvest on a weekly basis. Berry sampling was conducted by selecting 30 randomly berries from each vine. Care was taken to select berries from different parts of the clusters to insure a representative sample. These berries were then transferred into plastic collection bags and placed into a -20^{o}C freezer until analysis was performed. At harvest, each vine used in the experiment was hand harvested. At the time of laboratory analysis, samples

were allowed to warm to room temperature before being placed into 50 ml centrifuge tube and homogenized. After the samples were homogenized, approximately 1g ± 0.05g worth of the homogenate was massed out and placed into a 15 ml centrifuge tube to be used for Anthocyanin and total phenolic assay as described by Iland et al., 2004. Readings from this sample of absorbance were gathered using a UV-Vis spectrophotometer (Model UV-1800, Shimadzu Corporation, Kyoto, Japan) at wavelengths of 280nm, 520nm, and 700nm as called for in the procedure. The remaining sample of the homogenate in the 50ml tube was centrifuged for 10 min at 4000 rpm. The surfactant produced in this process was then used as clarified juice for testing of total soluble solids, pH, and titratable acidity.

Results:

The three different levels of yield per vine imposed at fruit set, significantly impacted vine yield at harvest; LC vines had half of the production when compared to HC vines, but not different from the medium level. The reduction in yield was around 50% for LC vines and about 30% for MC vines, when compared to HC vines (Table 1). However, any of the cluster parameters (measured at harvest) were impacted by the different treatments; at harvest cluster weight, berries per cluster and berry weight were similar for all the treatments.

Table 1. Yield components in Crop load Field Experiment from SWMREC in 2015.

Treatment	Yield Tons/acre	Cluster/ vine	Cluster weight (g)	Berries / cluster	Avg. berry weight (g)
High	5.1 a	62 a	98.0 a	81 a	1.1 a
Medium	3.4 b	45 b	97.8 a	78 a	1.3 a
Low	2.6 b	32 b	98.8 a	82 a	1.2 a

Treatment means followed by the same letter within a column are not significantly different at the α=0.05 level. Columns where no letters are present indicate a lack of significant differences among treatments.

Yield per vine had a significant impact on basic fruit chemistry. Sugar concentration of the berry at harvest, indexed as Brix was increased in LC, when compared to HC and MC vines. However, this difference was not reflected in phenols and color compounds concentration (Table 2) that remained unchanged in relation to the crop load treatments.

Table 2. Fruit chemical composition at harvest for Crop load Field Experiment from SWMREC in 2013.

Treatment	TSS (°Brix)	pH	TA (g/L)	Phenolics (a.u./g)	Anthocyanin (mol/g)
High	21.5 b	3.5 a	9.9 a	0.88 a	1.2 a
Medium	21.9 b	3.6 a	9.1 a	0.84 a	1.1 a
Low	23.8 a	3.7 a	9.2 a	0.79 a	1.2 a

Treatment means followed by the same letter within a column are not significantly different at the α=0.05 level. Columns where no letters are present indicate a lack of significant differences among treatments.

What the results mean:

- The cropping treatments impacted yield per vine at the time of harvest but no other yield component parameters (Table 1)
- The difference between the high cropping treatment and low cropping treatment was nearly 3 kilograms of fruit per vine, which is double yield (or double number of cluster per vine).
- The large difference in yield but did not affect the number of berries per cluster, cluster weight, or average berry weight.
- Fruit chemical composition at harvest showed a significant impact only on total soluble solids.

- Several other chemical parameters, strongly related to wine quality, were not impacted by the cropping treatments.